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Tani et al.

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(54) **IMAGE FORMING APPARATUS AND CARTRIDGE**

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G03G 21/18 (2006.01)

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CPC ***G03G 15/0189*** (2013.01); ***G03G 21/185*** (2013.01); ***G03G 21/1896*** (2013.01); *G03G 2215/0132* (2013.01)

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USPC 399/9, 12, 13, 25; 347/138, 152
See application file for complete search history.

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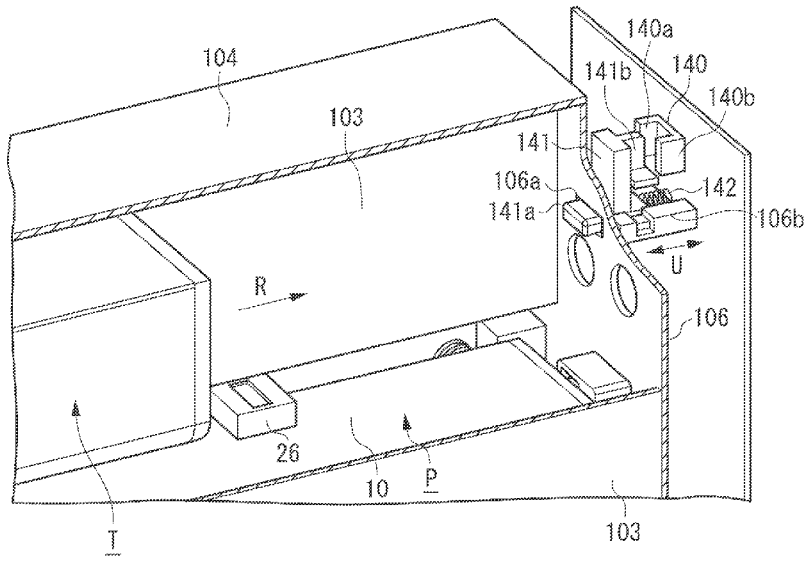
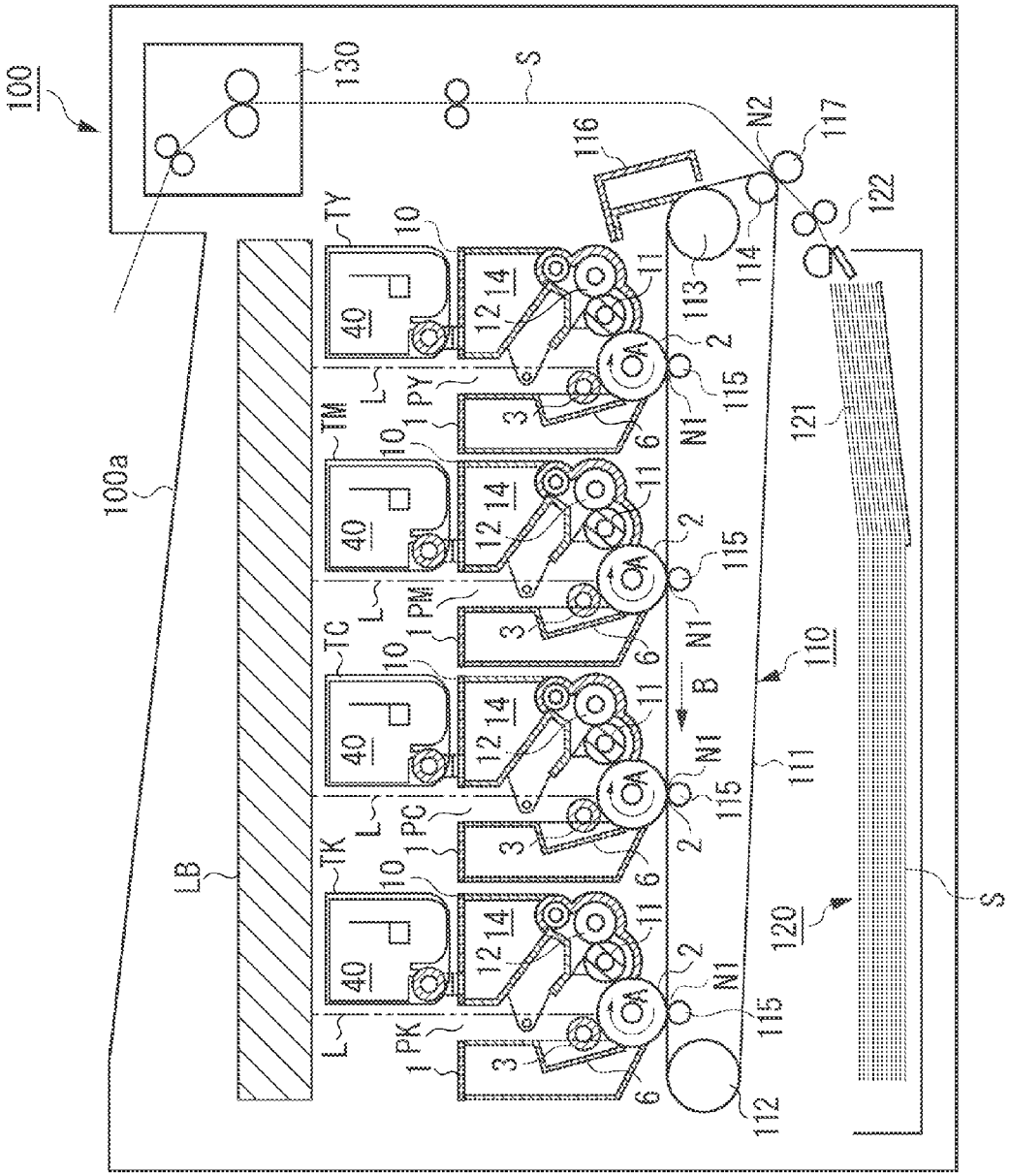
(57) **ABSTRACT**

An image forming apparatus includes a moving member equipped with a pressed portion and a detected portion, and in which the detected portion is configured to move to a predetermined position above the pressed portion by the pressed portion being pressed by the cartridge when the cartridge is attached to the image forming apparatus main body, and a detection device configured to detect whether the cartridge is attached by detection light passing the predetermined position.

26 Claims, 13 Drawing Sheets

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N2
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116
122
TY
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12 14
11
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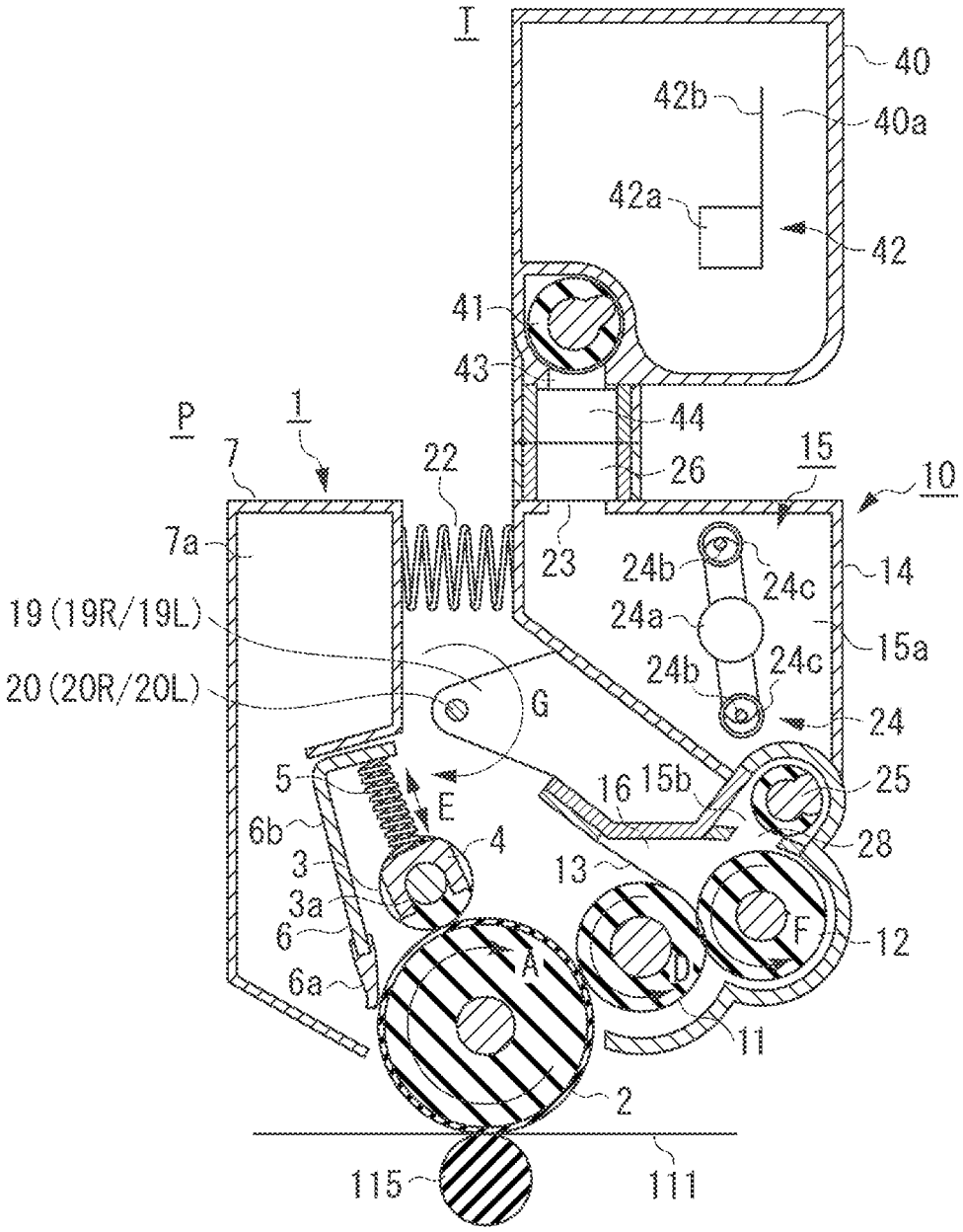
114
2
115
N1
121
L
1 PY
3
6
TM
1 PM
TC
1 PC
TK
1 PK
100a
LB
B
110
111
120
112

FIG. 1

FIG. 2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40
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40a
42a
42
41
43
44
26
15
10
P
1
7
22
7a
23
24b
24c
14
19 (19R/19L)
24a
15a
20 (20R/20L)
24b
24c
G
24
5
16
15b
25
E
6b
4
28
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13
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F
12
6
A
D
6a
11
2
115
111

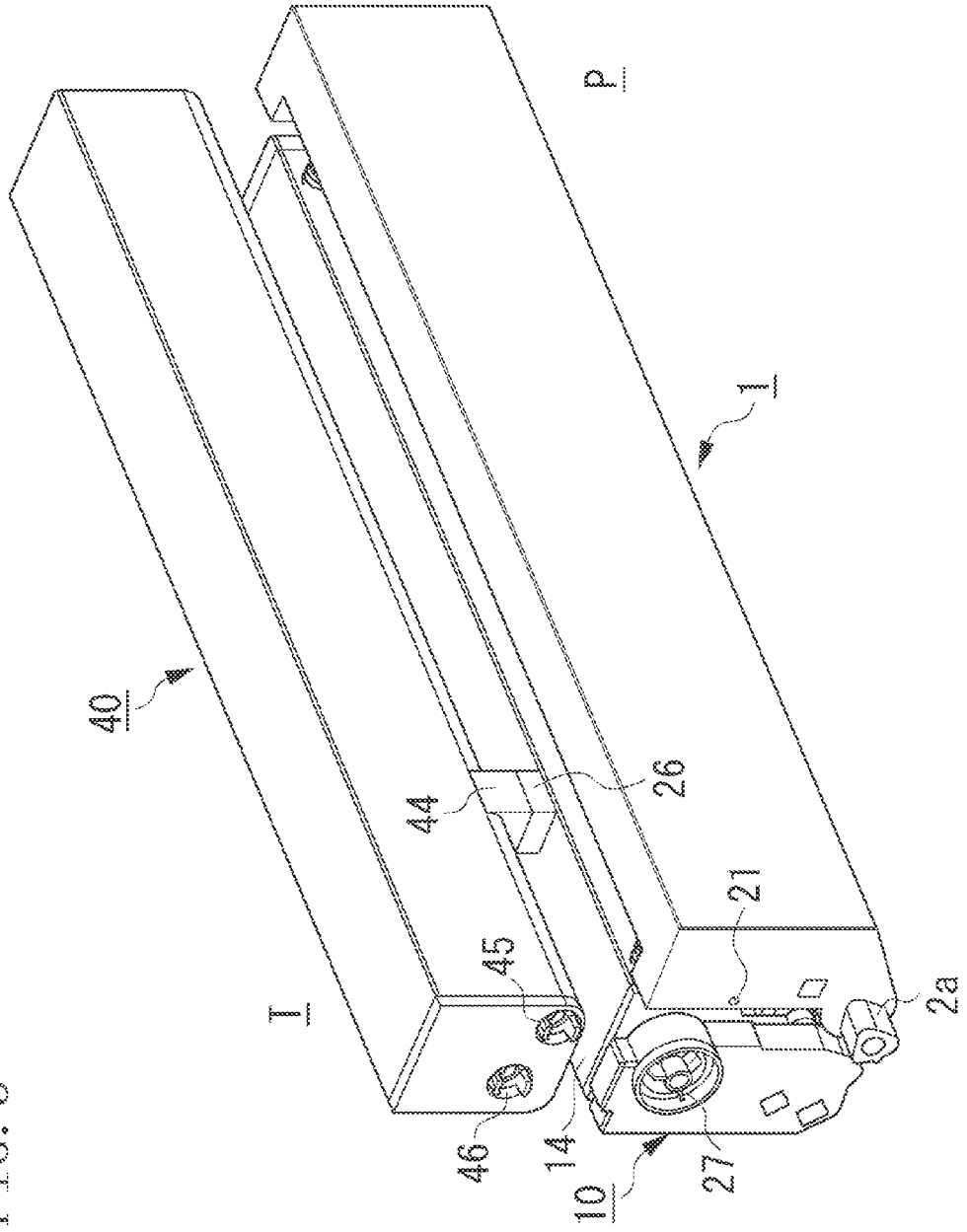


FIG. 3

FIG. 4

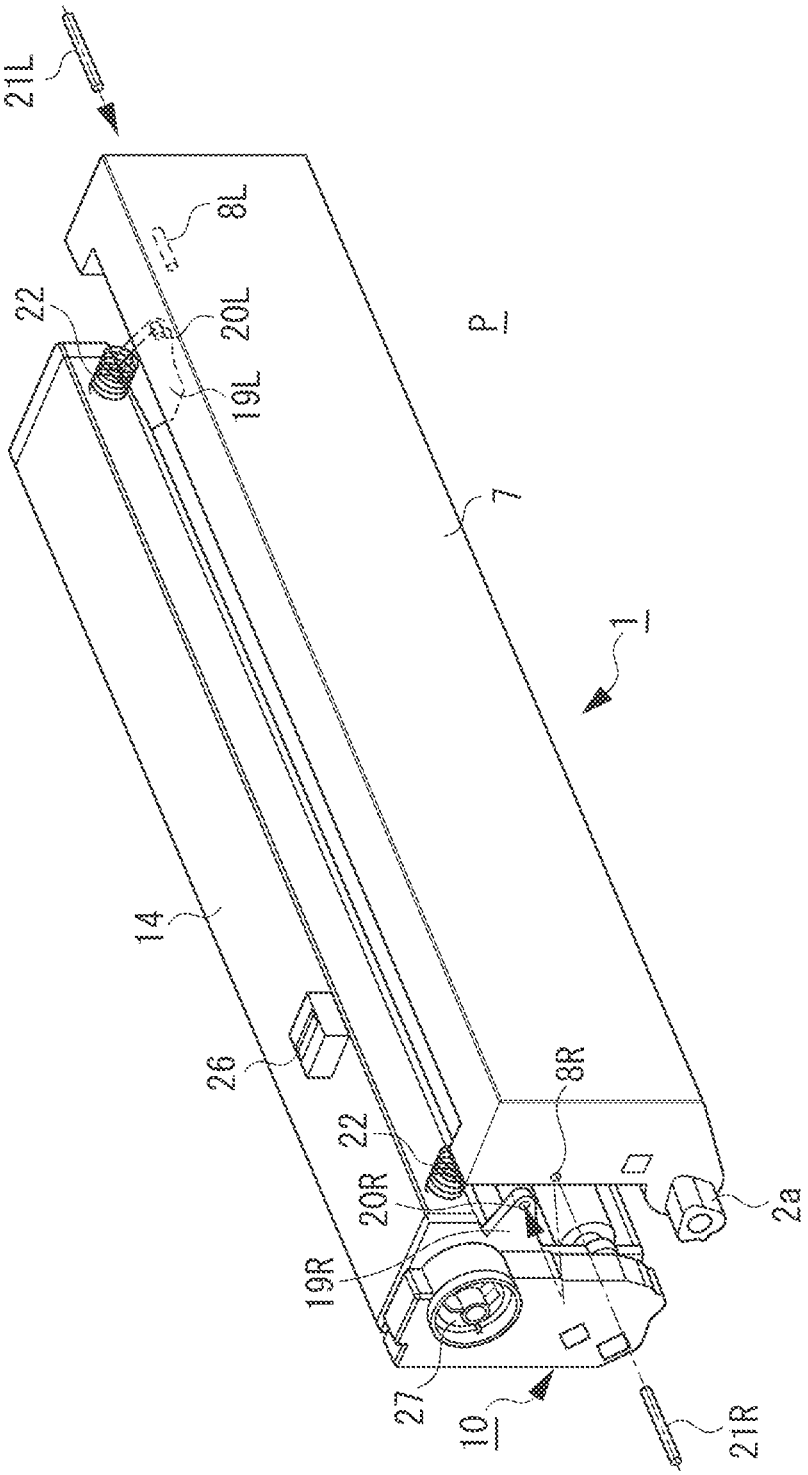
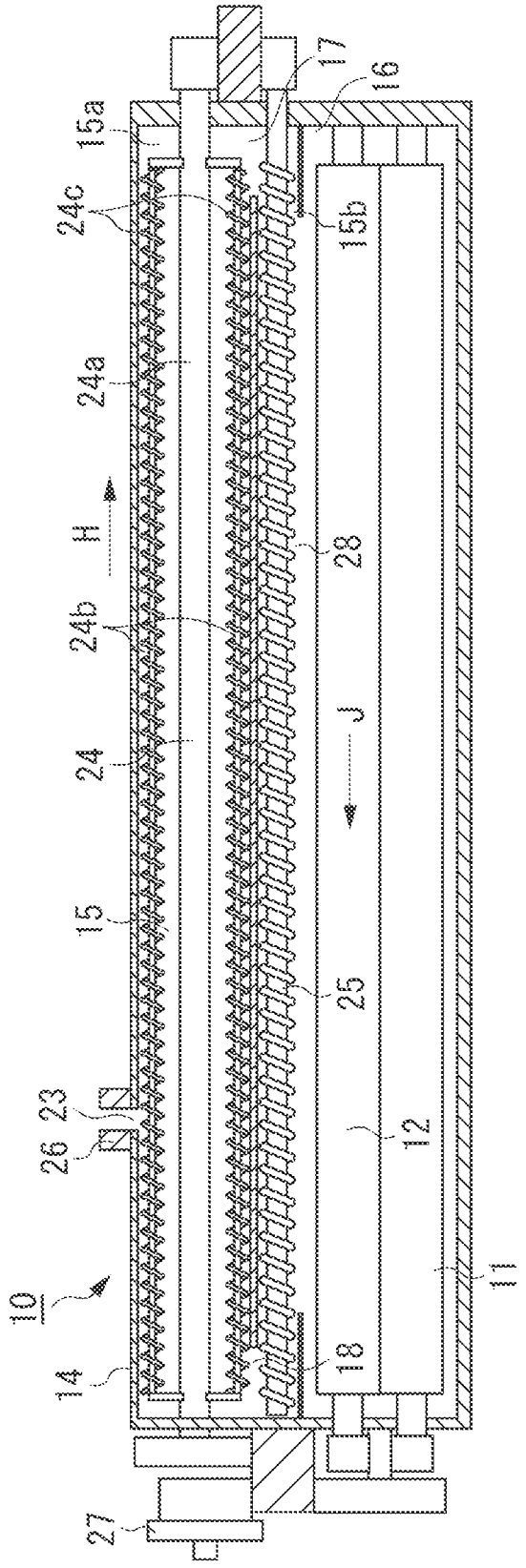


FIG. 5



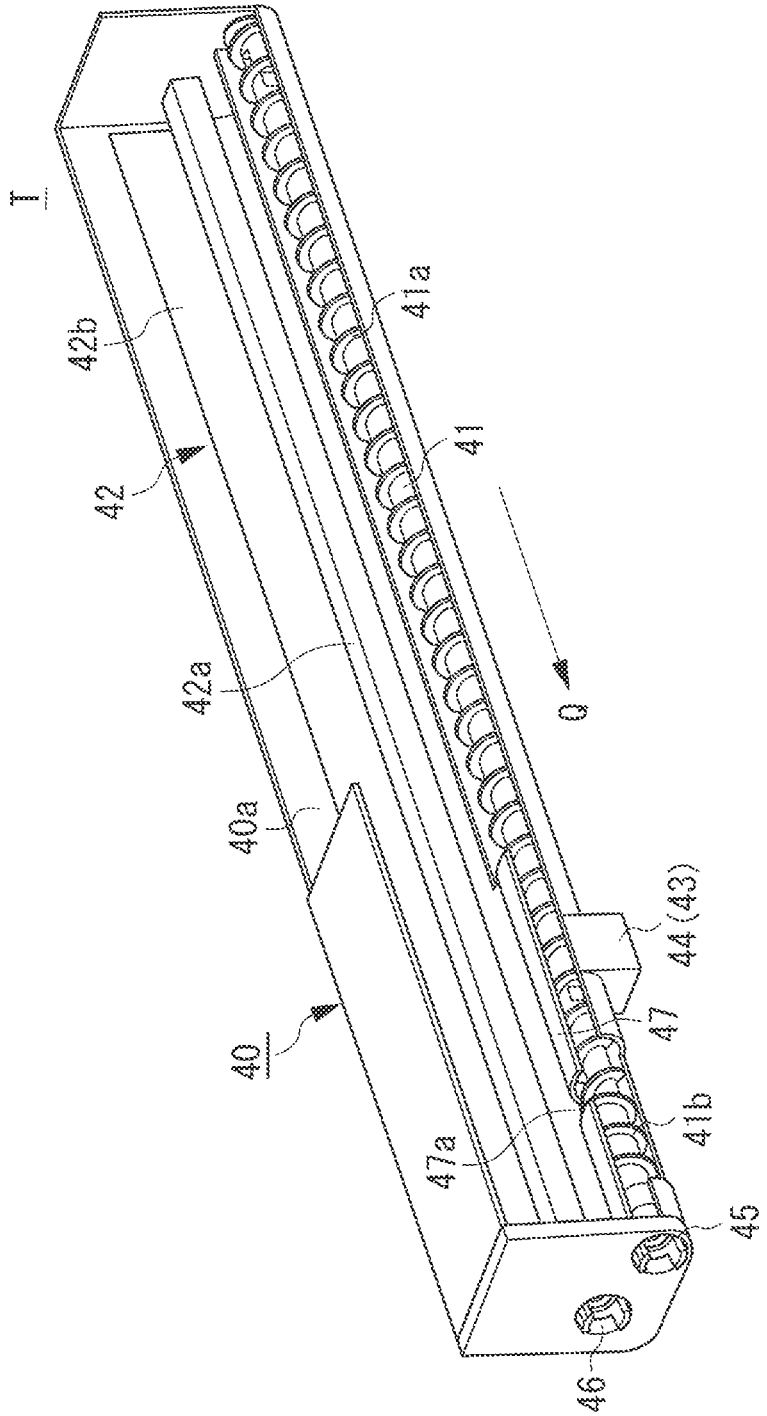
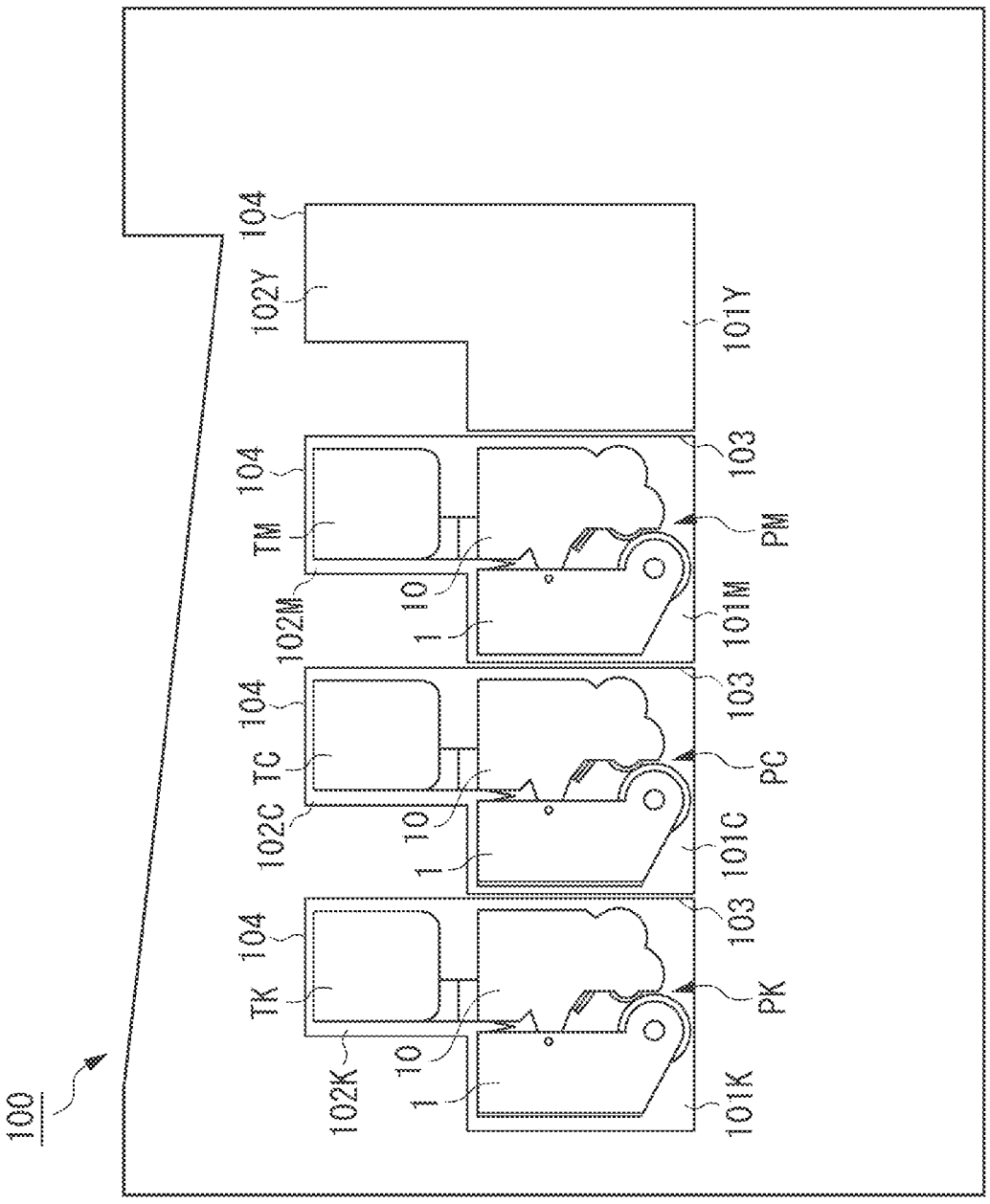


FIG. 6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104
102Y
101Y
103
PM
TM
104
102M
10
1
101M
103
PC
TC
104
102C
10
1
101C
103
PK
TK
104
102K
10
1
101K

FIG. 7

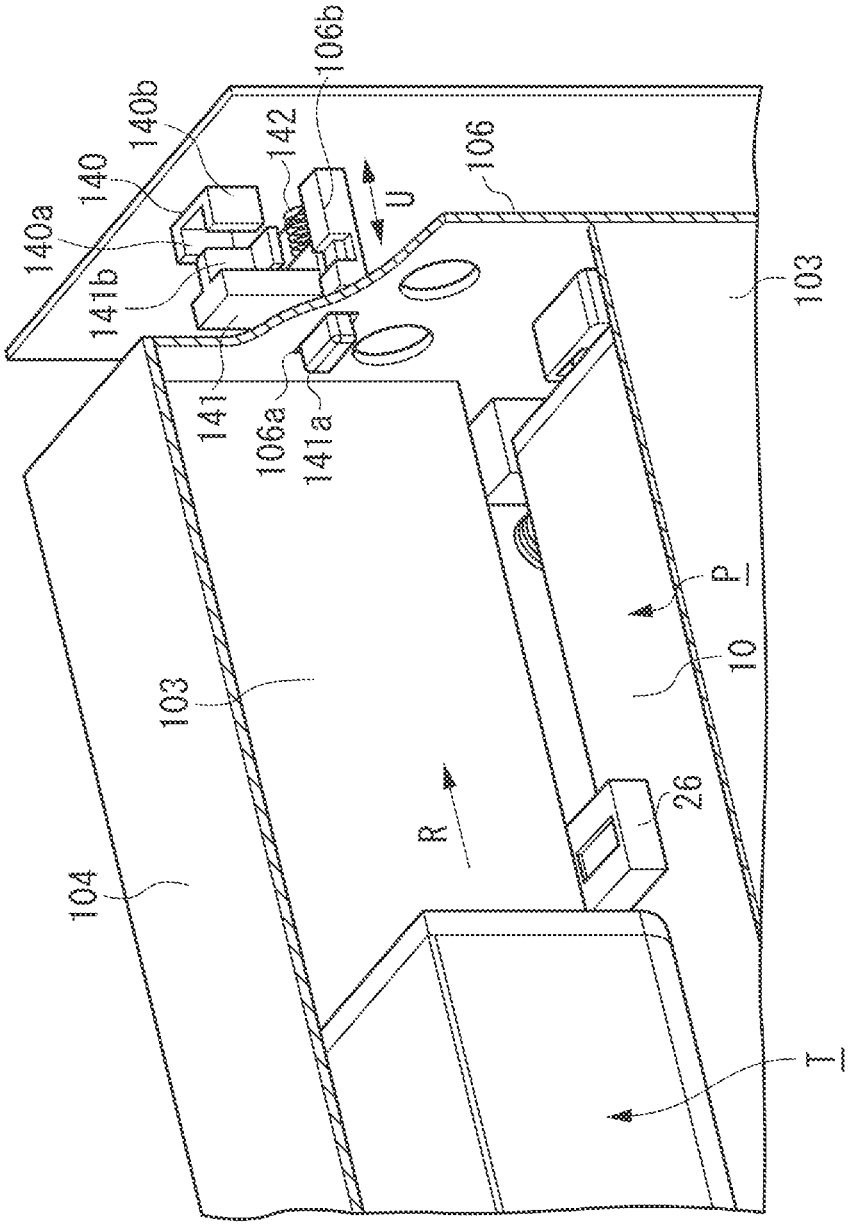

106b
140b
142
140
106
U
140a
141b
103
141
106a
141a
P
10
103
26
R
104
I

FIG. 8

FIG. 9A

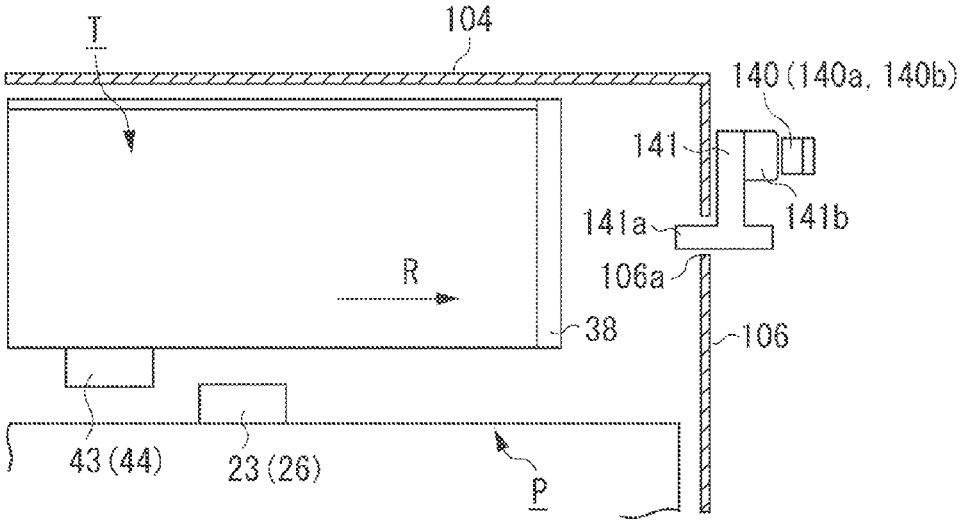
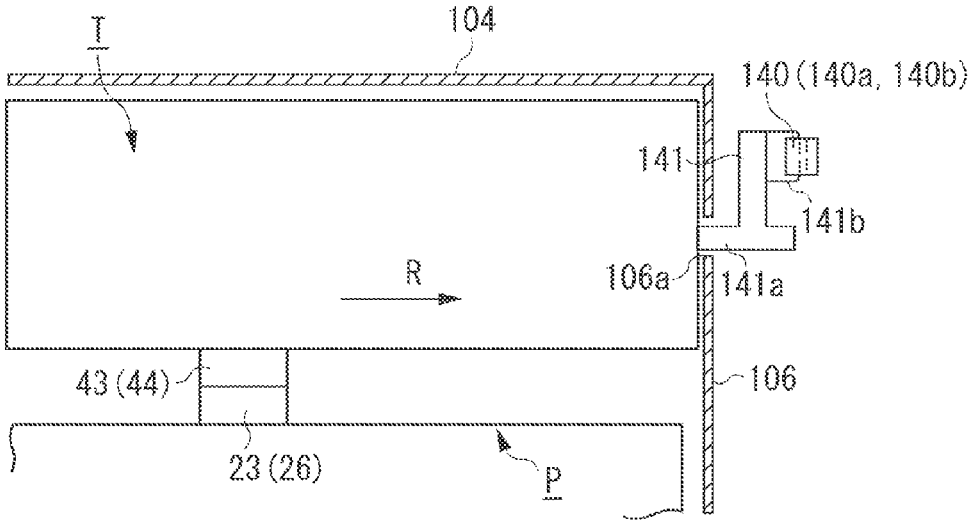

I
104
140 (140a, 140b)
141
141b
141a
106a
R
38
106
43 (44)
23 (26)
P

FIG. 9B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141b
R
106a
141a
106
43 (44)
23 (26)
P

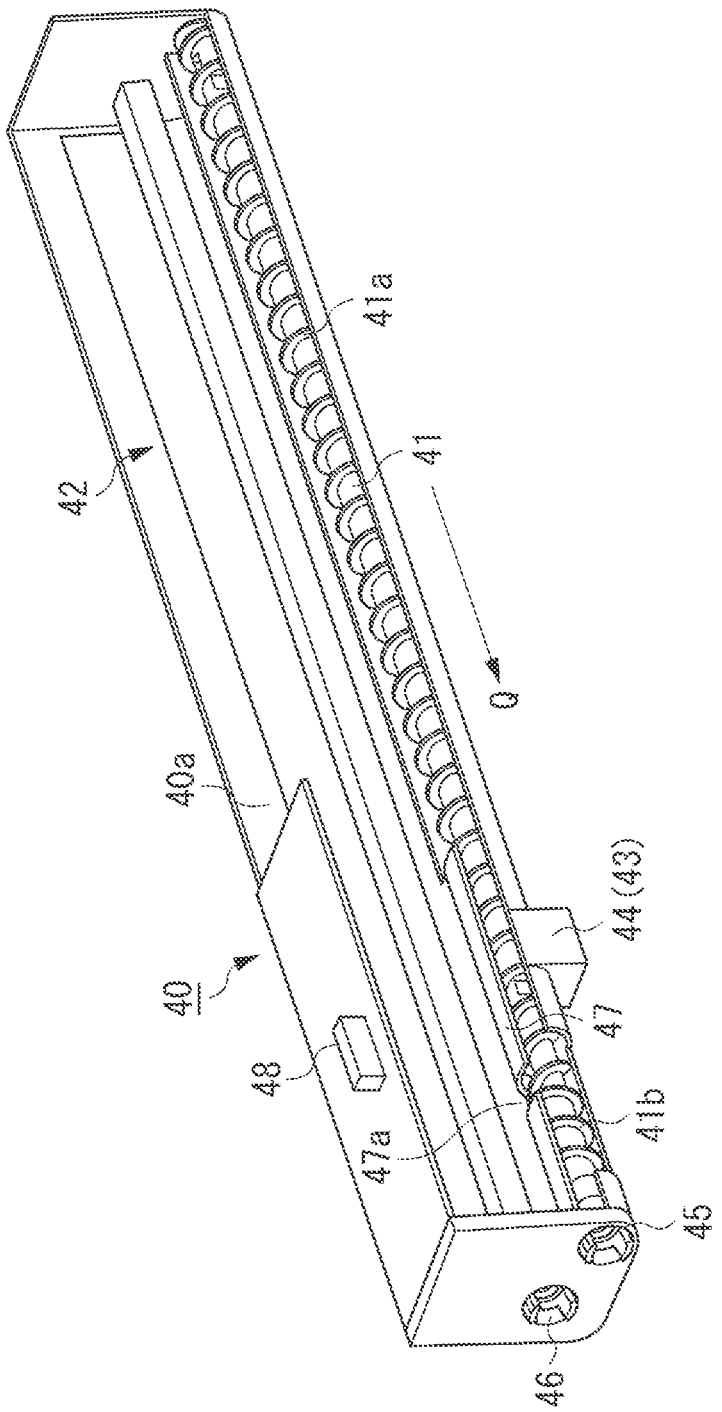


FIG. 10

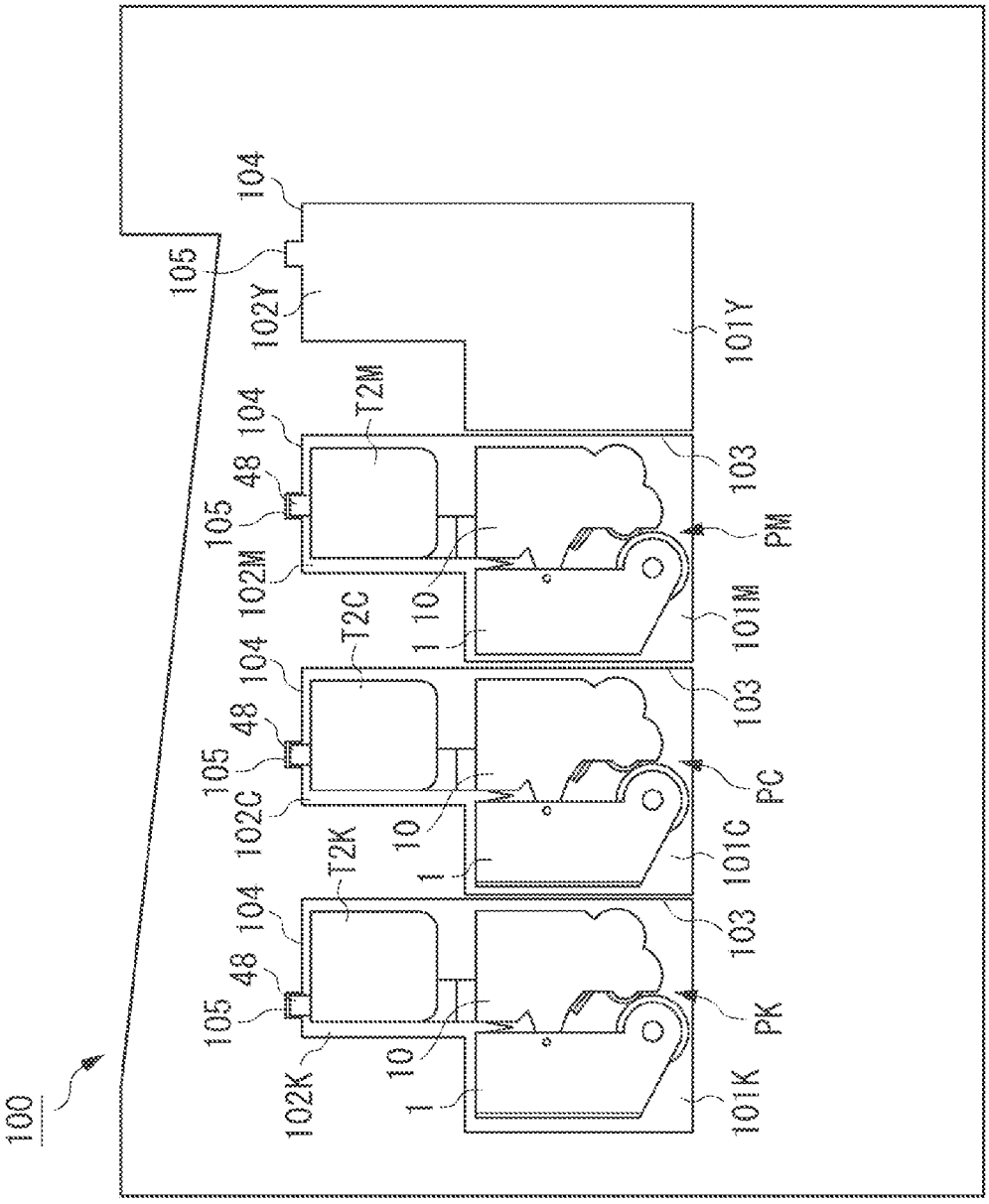
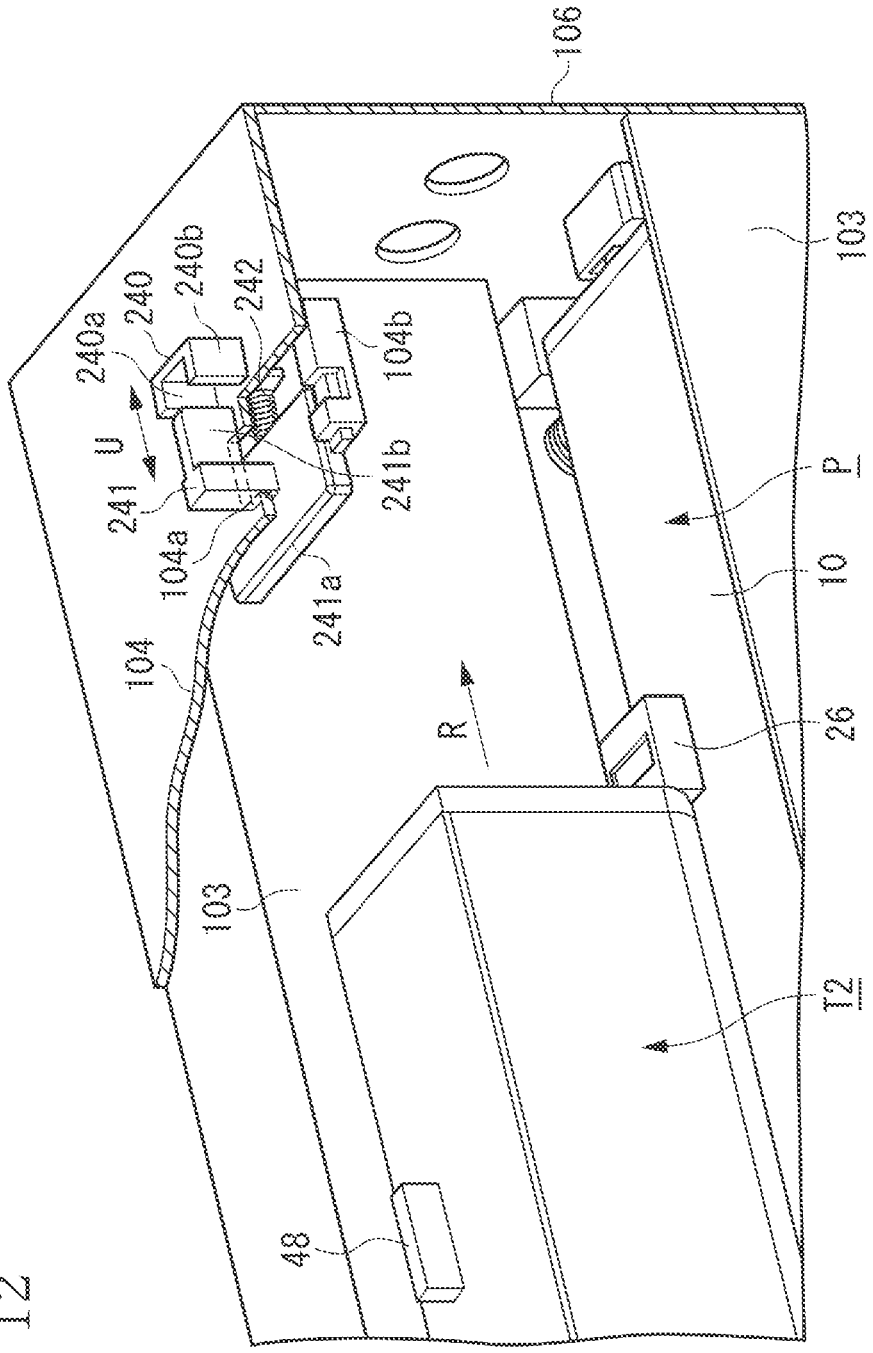

100
104
105
102Y
101Y
T2M
104
48
105
102M
103
PM
T2C
1 10
101M
104
48
105
102C
103
PC
T2K
1 10
101C
104
48
105
102K
103
PK
1 10
101K

FIG. 11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240a
240
240b
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104b
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U
241b
104a
241a
104
P
10
R
26
103
T2
48

FIG. 12

FIG. 13A

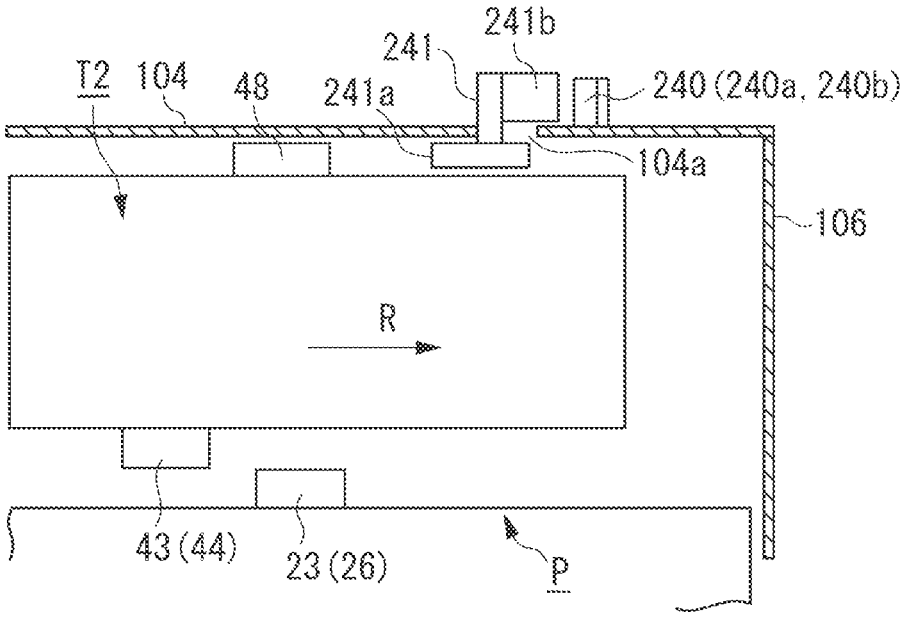

FIG. 13B

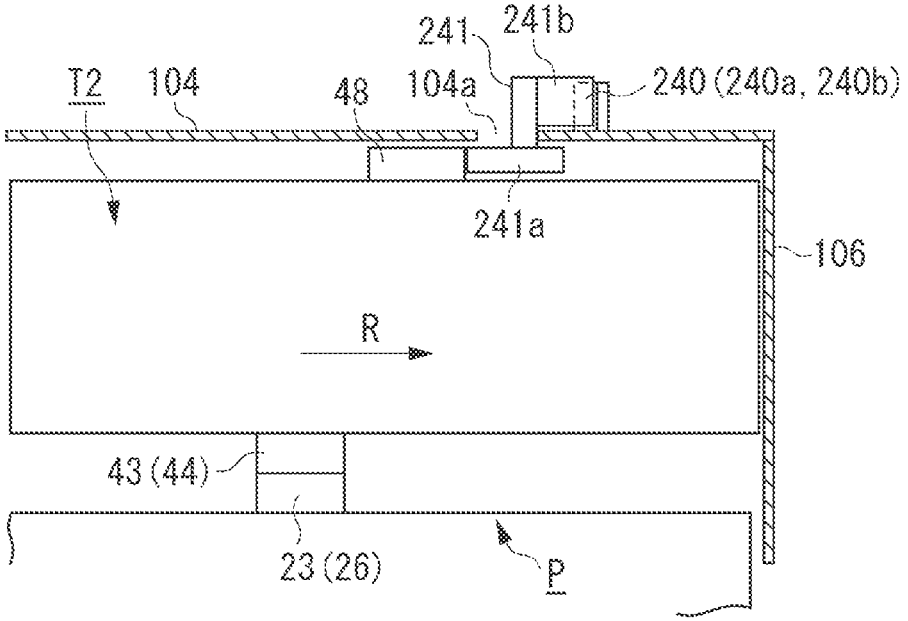

IMAGE FORMING APPARATUS AND CARTRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a process cartridge and a developer replenishment cartridge that are attachable/detachable to/from an electrophotographic image forming apparatus main body, and to an electrophotographic image forming apparatus employing these cartridges.

An electrophotographic image forming apparatus (hereinafter referred to as an "image forming apparatus") is an apparatus configured to form an image on a recording medium by using an electrophotographic image forming process. Examples of an electrophotographic image forming apparatus include an electrophotographic copying machine, an electrophotographic printer (such as a light-emitting diode (LED) printer and a laser beam printer), an electrophotographic facsimile apparatus, and an electrophotographic word processor.

A recording medium is an object on which an image is formed, for example, a recording sheet and an overhead projector (OHP) sheet.

2. Description of the Related Art

Conventionally, an image forming apparatus has employed a process cartridge system in which an electrophotogrpahic photosensitive member and a process unit acting thereon are integrated into a cartridge, which is attachable/detachable to/from an image forming apparatus main body. The process cartridge system helps to achieve an improvement in terms of operability since it enables users to perform maintenance on the apparatus by themselves.

A process cartridge is formed by a cleaning unit and a development unit. The cleaning unit includes an image bearing member as an electrophotographic photosensitive member, and a cleaning member configured to clean the surface of the image bearing member. The development unit includes a development roller for supplying developer to the image bearing member, and a developer storage unit storing developer.

On the other hand, a developer replenishment system is known as an example of the process cartridge system. In this system, a developer replenishment opening of a developer replenishment cartridge and a developer reception opening of a process cartridge are detachably connected to each other, with developer being supplied from the developer replenishment cartridge to the process cartridge (See FIG. 4 on page 14 of Japanese Patent Application Laid-Open No. 2010-014890).

On the other hand, there has been proposed a system in which there are provided a light transmission type detection sensor for detecting the attachment condition of a process cartridge, and a sensor lever configured to act thereon, and the sensor lever is moved in conjunction with the attachment of the process cartridge to thereby detect the attachment condition of the process cartridge (See FIG. 2 on page 10 of Japanese Patent Application Laid-Open No. 2005-345939).

SUMMARY OF THE INVENTION

The present invention is directed to an image forming apparatus having a detection device configured to detect by detection light whether a cartridge storing developer has been attached to an image forming apparatus main body, thereby reducing erroneous detection by the detection device.

According to an aspect of the present invention, an image forming apparatus includes: a development unit configured to develop an electrostatic image formed on an electrophotographic photosensitive member; a cartridge configured to replenish the development unit with developer and detachable with respect to an image forming apparatus main body; a moving member equipped with a pressed portion and a detected portion, with the detected portion being configured to move to a predetermined position above the pressed portion through pressing of the pressed portion by the cartridge when the cartridge is attached to the image forming apparatus main body; and a detection device configured to detect whether the cartridge has been attached by detection light passing the predetermined position.

According to another aspect of the present invention, a cartridge for replenishing a development unit configured to develop an electrostatic image formed on an electrophotographic photosensitive member with developer, includes: a pressing portion provided so as to be detachable with respect to an image forming apparatus main body including a moving member equipped with a pressed portion and a detected portion, with the detected portion being configured to move to a predetermined position above the pressed portion through pressing of the pressed portion by the cartridge when the cartridge is attached to the image forming apparatus main body, and a detection device configured to detect whether the cartridge has been attached by detection light passing the predetermined position, wherein the pressing portion is configured to move the pressed portion to the predetermined position above the pressed portion through pressing of the pressed portion when the cartridge is attached to the image forming apparatus main body.

Further features and aspects of the present invention will become apparent from the following detailed description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate exemplary embodiments, features, and aspects of the invention and, together with the description, serve to explain the principles of the invention.

FIG. **1** is a schematic sectional view of a color electrophotographic image forming apparatus according to an exemplary embodiment of the present invention.

FIG. **2** is a main portion sectional view of a process cartridge and a developer replenishment cartridge according to an exemplary embodiment of the present invention.

FIG. **3** is an overall view of the process cartridge and the developer replenishment cartridge in an image forming apparatus according to an exemplary embodiment of the present invention.

FIG. **4** is an overall view of the process cartridge according to an exemplary embodiment of the present invention.

FIG. **5** is a sectional view of a development unit according to an exemplary embodiment of the present invention.

FIG. **6** is a perspective view of the developer replenishment cartridge according to an exemplary embodiment of the present invention.

FIG. **7** is a front view of a process cartridge attachment portion and a developer replenishment cartridge attachment portion according to an exemplary embodiment of the present invention.

FIG. **8** is a detailed view of a developer replenishment cartridge attachment portion according to a first exemplary embodiment of the present invention.

FIG. **9** is a diagram illustrating a developer replenishment cartridge attachment operation according to the first exemplary embodiment of the present invention.

FIG. **10** is a perspective view illustrating a construction of a developer replenishment cartridge according to a second exemplary embodiment of the present invention.

FIG. **11** is a front view of a process cartridge attachment portion and a developer replenishment cartridge attachment portion according to the second exemplary embodiment of the present invention.

FIG. **12** is a detailed view of the developer replenishment cartridge attachment portion according to the second exemplary embodiment of the present invention.

FIGS. **13**A and **13**B are diagrams illustrating a developer replenishment cartridge attachment operation according to the second exemplary embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

Various exemplary embodiments, features, and aspects of the invention will be described in detail below with reference to the drawings.

Hereinbelow, a color image forming apparatus employing a developer replenishment cartridge and a process cartridge according to an exemplary embodiment of the present invention will be described with reference to the drawings.

First, an overall construction of the image forming apparatus will be described with reference to FIGS. **1** and **2**. FIG. **1** is a schematic sectional view of a color electrophotographic image forming apparatus. FIG. **2** is a main portion sectional view of a process cartridge and a developer replenishment cartridge.

An image forming apparatus **100** illustrated in FIG. **1** is a full four-color laser printer employing the electrophotographic process. The image forming apparatus performs color image formation on a recording medium S. The image forming apparatus **100** is a process cartridge type image forming apparatus employing a developer replenishment system. In this system, a process cartridge P and a developer replenishment cartridge T are detachably attached to the main body of the image forming apparatus **100** to form a color image on the recording medium S.

In the following description, the image forming apparatus main body (hereinafter referred to as the apparatus main body) refers to the portion of the image forming apparatus excluding the process cartridge P and the developer replenishment cartridge T.

In the apparatus main body **100**, first through fourth process cartridges P (PY, PM, PC, and PK) and first through fourth developer replenishment cartridges T (TY, TM, TC, and TK) are horizontally arranged side by side. The process cartridges P and the developer replenishment cartridges T are of a similar electrophotographic process mechanism and differ from each other in developer color and in amount of developer charged therein.

A rotational drive force is transmitted from the apparatus main body **100** to the process cartridges P and the developer replenishment cartridges T. Further, a bias (charging bias, development bias, etc.) is supplied from the apparatus main body **100** to the process cartridges P. The process cartridges P and the developer replenishment cartridges T are independently attachable/detachable to/from the apparatus main body **100**.

As illustrated in FIG. **2**, each process cartridge P according to the present exemplary embodiment is composed of a cleaning unit **1** and a development unit **10**. The cleaning unit **1** is equipped with an electrophotographic photosensitive drum **2** (hereinafter referred to as the photosensitive drum) as an image bearing member, a charging roller **3** acting on this photosensitive drum **2**, and a cleaning member **6**.

The development unit **10** has a development means for developing an electrostatic latent image (electrostatic image) on the photosensitive drum **2**. The cleaning unit **1** and the development unit **10** are swingably connected to each other.

The first process cartridge PY stores yellow (Y) developer inside a developer storage unit **15**, and is configured to form a yellow developer image on the surface of the photosensitive drum **2**. Similarly, the second process cartridge PM stores magenta (M) developer, the third process cartridge PC stores cyan (C) developer, and the fourth process cartridge PK stores black (K) developer.

On the other hand, the first developer replenishment cartridge TY stores yellow (Y) developer in a replenishment frame body **40**, and supplies yellow developer to the process cartridge PY storing developer of the same color. Similarly, the second developer replenishment cartridge TM stores magenta (M) developer, and supplies magenta developer to the process cartridge PM storing developer of the same color.

Similarly, the third developer replenishment cartridge TC stores cyan (C) developer, and supplies cyan developer to the process cartridge PC storing developer of the same color. Similarly, the fourth developer replenishment cartridge TK stores black (K) developer, and supplies black developer to the process cartridge PK storing developer of the same color.

As illustrated in FIG. **2**, in the lower portion of a replenishment frame body **40** of the developer replenishment cartridge T, there is provided a developer replenishment opening **43** for replenishing the process cartridge with developer. The development storage unit **15** of the process cartridge P is provided with a developer reception opening **23** corresponding to the developer replenishment opening **43**.

When the process cartridge P and the developer replenishment cartridge T are attached to the apparatus main body **100**, the developer replenishment opening **43** and the developer reception opening **23** are communicated with each other, and developer is supplied from the developer replenishment cartridge T to the process cartridge P.

The process cartridge P and the developer replenishment cartridge T will be described in detail below.

As illustrated in FIG. **1**, a laser scanner unit LB as an exposure unit is arranged above the process cartridges P (PY, PM, PC, and PK). The laser scanner unit LB outputs laser light L corresponding to the image information. The laser light L is used for scanning exposure of the surfaces of the photosensitive drums **2**.

Under the process cartridges P (PY, PM, PC, and PK), there is arranged an intermediate transfer belt unit **110** as a primary transfer member. The intermediate transfer belt unit **110** includes a flexible endless transfer belt **111**, a driving roller **112** configured to rotate the transfer belt **111** in stretched manner, a driven roller **113**, and a secondary transfer opposing roller **114**.

The respective photosensitive drums **2** of the process cartridges Pare in contact with the transfer belt **111**. Contact portions N1 between the photosensitive drums **2** and the transfer belt **111** constitute primary transfer portions. On the inner side of the transfer belt **111**, there are arranged primary transfer rollers **115** so as to be opposed to the photosensitive drums **2**.

At a position opposing the secondary transfer opposing roller **114**, there is arranged a secondary transfer roller **117** as the secondary transfer member. The contact portion N2 between of the transfer belt **111** and the secondary transfer roller **117** constitutes a secondary transfer portion.

A feeding unit **120** is arranged below the intermediate transfer belt unit **110**. The feeding unit **120** includes a feeding tray **121** storing the recording media S, and feeding rollers **122**.

A fixing unit **130** is arranged in the upper portion in the apparatus main body **100**. The upper surface of the apparatus main body **100** constitutes a discharge tray **100***a*.

Next, the operation of forming a full color image will be described with reference to FIG. **1**. FIG. **1** is a schematic sectional view illustrating a color electrophotographic image forming apparatus.

The full color image forming operation is as follows. The respective photosensitive drums **2** of the first through fourth process cartridges P (PY, PM, PC, and PK) are rotated in the direction of the arrow A at a predetermined speed. The transfer belt **111** is also rotated in the direction of the arrow B (in the forward direction with respect to the rotation of the photosensitive drums). At this time, the speed of the transfer belt **111** corresponds to the speed of the photosensitive drums **2**. At the same time, the laser scanner unit LB is driven.

In synchronization with the driving of the laser scanner unit LB, the respective charging rollers **3** of the process cartridges P uniformly charge the surfaces of the photosensitive drums **2** to a predetermined polarity and potential. The laser scanner unit LB performs scanning exposure on the surfaces of the photosensitive drums **2** with laser light L corresponding to image signals of the different colors. As a result, electrostatic latent images corresponding to the image signals of the corresponding colors are formed on the respective surfaces of the photosensitive drums **2**. The electrostatic latent images formed are developed by the development rollers **11**.

Through the above image forming operation, a yellow developer image is formed on the photosensitive drum **2** of the first process cartridge PY. Then, the yellow developer image is primary-transferred onto the transfer belt **111**. Similarly, the developer images of the second process cartridge PM, the third process cartridge PC, and the fourth process cartridge PK are superposed one upon the other on the transfer belt **111**, whereby an unfixed full four-color developer image is formed.

On the other hand, the recording medium S stored in the feeding tray **121** is fed at a predetermined control timing. The full four-color developer image on the transfer belt **111** is collectively transferred onto the surface of the recording medium S that is introduced into the secondary transfer portion N**2**.

The recording medium S is separated from the surface of the transfer belt **111** and is introduced into a fixing unit **130**. Then, it is heated and pressurized at a fixing nip portion. As a result, the developer image is fixed to the recording medium S. After this, the recording medium S that has been fixed is conveyed to a discharge tray **100***a*, whereby the full-color image forming operation is completed.

Next, the overall configuration of the process cartridge P will be described with reference to FIGS. **2**, **3**, and **4**. FIG. **2** is a main portion sectional view of the process cartridge and the developer replenishment cartridge. FIG. **3** is an overall diagram illustrating the developer replenishment cartridge T and the process cartridge P in the apparatus main body. FIG. **4** is an overall diagram of the process cartridge.

As illustrated in FIG. **2**, the process cartridge P (PY, PM, PC, and PK) is formed by a cleaning unit **1** and a development unit **10**.

First, the cleaning unit **1** will be described. The cleaning unit **1** includes a cleaning frame body **7**, a photosensitive drum **2**, a charging roller **3**, and a cleaning member **6**.

The photosensitive drum **2** is rotatably supported by the cleaning frame body **7**. As illustrated in FIG. **3**, at one end of the photosensitive drum **2**, there is provided a drum drive coupling **2***a*. The photosensitive drum **2** and the drive coupling **2***a* are formed integrally. The drum drive coupling **2***a* is engaged with a coupling (not illustrated) of the apparatus main body **100**.

The drive force of a drive motor (not illustrated) of the apparatus main body **100** is transmitted to the drum drive coupling **2***a*, whereby the photosensitive drum **2** is rotated in the direction of the arrow A of FIG. **2** at a predetermined speed.

The charging roller **3** is driven to be rotated while being in contact with the photosensitive drum **2**. As illustrated in FIG. **2**, the charging roller **3** is mounted to the cleaning frame body **7** via a charging roller bearing **4**.

The charging roller **3** is mounted so as to be movable in the direction of the arrow E along the line connecting the rotation center of the charging roller **3** and the rotation center of the photosensitive drum **2**. A rotation shaft **3***a* of the charging roller **3** is rotatably supported by the charging roller bearing **4**. The charging roller bearing **4** is urged toward the photosensitive drum **2** by a pressurization member **5**.

The cleaning member **6** is composed of an elastic rubber blade **6***a* at the distal end thereof and a support metal plate **6***b*. The distal end of the elastic rubber blade **6***a* is held in contact in a counter direction with respect to the rotational direction of the photosensitive drum **2** (the direction of the arrow A of FIG. **2**). The cleaning member **6** removes the developer remaining on the photosensitive drum **2**. The developer removed from the peripheral surface of the photosensitive drum **2** by the cleaning member **6** is stored in a removed developer storage unit **7***a*.

Next, the development unit **10** will be described. As illustrated in FIG. **2**, the development unit **10** has a development frame body **14** supporting various components in the development unit **10**. The development frame body **14** is divided into a development portion **16** and a developer storage unit **15**.

The development portion **16** is provided with a development roller **11**, a developer supply roller (hereinafter referred to as the "supply roller") **12**, and a development blade **13**. The development roller **11** rotates in the direction of the arrow D while being in contact with the photosensitive drum **2**.

The supply roller **12** rotates in the direction of the arrow F while being in contact with the development roller **11**. The supply roller **12** serves two functions: first, it supplies developer onto the development roller **11**; second, it scrapes off the portion of the developer remaining on the development roller **11** without being used for development. The development blade **13** is held in contact with the peripheral surface of the development roller **11**, thereby regulating the developer layer thickness on the development roller **11**.

On the other hand, the developer storage unit **15** stores the developer supplied from the developer replenishment cartridge T. The developer storage unit **15** will be described in detail below.

Next, the connection between the cleaning unit **1** and the development unit **10** will be described. As illustrated in FIG. **4**, the cleaning frame body **7** has cleaning connection holes (**8**R and **8**L).

As illustrated in FIGS. **2** and **5**, the development frame body **14** is provided with development side plates **19** (**19**R and **19**L) at both longitudinal ends thereof. The development side plates **19** (**19**R and **19**L) have development connection holes **20** (**20**R and **20**L). As illustrated in FIG. **4**, the cleaning connection holes **8** (**8**R and **8**R) and the development connection holes (**20**R and **20**L) are swigably connected together by

being fit-engaged with connection shafts **21** (**21**R and **21**L). As a result, the cleaning unit **1** and the development unit **10** are connected to each other.

As illustrated in FIGS. **2** and **5**, a pressurization spring **22** is arranged between the cleaning unit **1** and the development unit **10**. Due to the urging force of the pressurization spring **22**, the development unit **10** is provided with rotational moment in the direction of the arrow G around the development connection holes **20**. As a result, the development roller **11** is brought into contact with the photosensitive drum **2**.

In the present exemplary embodiment, the development roller **11** is arranged so as to be in contact with the photosensitive drum **2**, it is also possible for the development roller to be arranged at a predetermined interval from the photosensitive drum.

Next, the configuration of the developer storage unit **15** will be described with reference to FIG. **5**. FIG. **5** is a sectional view illustrating the configuration of the development unit **10**.

As illustrated in FIG. **5**, the developer storage unit **15** is divided into a first storage unit **15***a* and a second storage unit **15***b*. The first storage unit **15***a* and the second storage unit **15***b* are connected together by a first opening **17** and a second opening **18** provided at both longitudinal ends thereof.

The first storage unit **15***a* is provided with a developer reception opening **23**. A developer reception shutter **26** is arranged at an upper portion of the developer reception opening **23**. Normally, the developer reception shutter **26** is closed. It is open in the state in which the process cartridge P and the developer replenishment cartridge T are attached to the apparatus main body **100**.

The second storage unit **15***b* is connected to the development portion **16** via a development opening **28**. The first storage unit **15***a* is provided with a developer stirring member **24**. The developer stirring member **24** has two functions: first, it mixes the developer within the developer storage unit **15** with the developer supplied from the developer replenishment cartridge T; second, it conveys the resultant developer mixture in the direction of the arrow H.

The developer stirring member **24** has a stirring sprig **24***c* mounted to a development support shaft **24***b* provided around the developer stirring shaft **24***a*. On the other hand, the second storage unit **15***b* is provided with a developer conveyance member **25**. The developer conveyance member **25** is a screw member configured to covey the developer in the direction of the arrow J.

The conveyance of the developer in the development unit **10** will be described. In the first storage unit **15***a*, the developer supplied from the developer replenishment cartridge T is mixed with the developer within the developer storage unit **15** by the developer stirring member **24**. The resultant developer mixture is sent to the second storage unit **15***b* via the first opening **17**.

In the second storage unit **15***b*, the developer is conveyed from the development opening **28** to the development portion **16** by the developer conveyance member **25**. The developer conveyed to the development portion **16** is sent from the supply roller **12** to the development roller **11** to be used for development. The portion of the developer which has not been used for development returns from the development portion **16** to the second storage unit **15***b* again. After this, it is conveyed from the second opening **18** to the first storage unit **15***a*.

Next, a configuration of the developer replenishment cartridge T will be described with reference to FIGS. **2** and **6**. FIG. **2** is a main portion sectional view of the process cartridge and the developer replenishment cartridge. FIG. **6** is a perspective view illustrating a configuration of the developer replenishment cartridge T.

As illustrated in FIG. **2**, the developer replenishment cartridge T has a replenishment frame body **40** for storing developer. The replenishment frame body **40** has a developer replenishment opening **43** for replenishing the process cartridge P with developer.

A developer replenishment shutter **44** is provided under the developer replenishment opening **43**. Normally, the developer replenishment shutter **44** is closed. It is open in the state in which the process cartridge P and the developer replenishment cartridge T have been attached to the apparatus main body **100**.

A developer conveyance member **41** and a replenishment stirring member **42** are provided in the replenishment frame body **40**. The developer conveyance member **41** and the replenishment stirring member **42** are rotatably supported by the replenishment frame body **40**.

The replenishment conveyance member **41** conveys the developer in the replenishment frame body **40** toward the developer replenishment opening **43**. As illustrated in FIG. **6**, the replenishment conveyance member **41** is a screw member having on its surface a spiral fin **41***a* and a return fin **41***b*. The fin **41***a* conveys the developer in the direction of the arrow Q. The return fin **41***b* conveys the developer in a direction reverse to that of the fin **41***a*.

The replenishment stirring member **42** is formed by a replenishment stirring shaft **42***a* and a replenishment stirring sheet **42***b*. The replenishment stirring member **42** has two functions: first, it stirs the developer in the replenishment frame body **40**; second, it sends the stirred developer to the replenishment conveyance member **41**.

A cover member **47** is provided above the replenishment conveyance member **41**. The cover member **47** covers a part in the longitudinal direction of the developer replenishment opening **43** and the replenishment conveyance member **41**. The cover member **47** is provided with a return hole **47***a*.

At one longitudinal end of the replenishment conveyance member **41** and of the replenishment stirring member **42**, there are respectively provided a replenishment conveyance coupling **45** and a replenishment stirring coupling **46**. The replenishment conveyance coupling **45** and the replenishment stirring coupling **46** are engaged with a coupling (not illustrated) of the apparatus main body **100**.

The drive force of the drive motor (not illustrated) of the apparatus main body **100** is transmitted to the replenishment conveyance coupling **45** and the replenishment stirring coupling **46**, whereby the replenishment conveyance member **41** and the replenishment stirring member **42** are rotated at a predetermined speed.

The conveyance of the developer in the developer replenishment cartridge Twill be described. The developer in the replenishment frame body **40** is stirred by the replenishment stirring member **42**, and is sent to the replenishment conveyance member **41**. When it has been sent to the cover member **47**, the developer sent to the replenishment conveyance member **41** is partially regulated by the cover member **47**. As a result, the amount of developer discharged from the developer replenishment opening **43** becomes constant.

The developer conveyed into the cover member **47** is discharged to the process cartridge P through the developer replenishment opening **43**. The developer which has not been discharged from the developer replenishment opening **43** is sent through the return hole **47***a* to the replenishment stirring member **42** by the return fin **41***b*, and is stirred again.

Next, a configuration related to the attachment detection of the developer replenishment cartridge, which is a feature of the present invention, will be described in detail.

First, referring to FIGS. **7** and **8**, a cartridge attachment portion of the apparatus main body **100** will be described. FIG. **7** is a front view of a process cartridge attachment portion **101** and a developer replenishment cartridge attachment portion **102** of the apparatus main body **100**.

FIG. **8** is a detailed view illustrating a rear side of the apparatus main body **100** of the developer replenishment cartridge attachment portion **102**. As illustrated in FIG. **7**, the process cartridge attachment portions **101** (**101**Y through **101**K) and the developer replenishment cartridge attachment portions **102** (**102**Y through **102**K) are divided from the adjacent cartridge attachment portions by side walls **103**, upper walls **104**, a rear wall **106** (See FIG. **8**), etc. The cartridge attachment portions are independent of each other.

As illustrated in FIG. **8**, a detection sensor **140** is provided on the outer side (the downstream side in the developer replenishment cartridge attachment direction) of the rear wall **106** (first partition member) on the rear side of the developer replenishment cartridge attachment portion **102**. This detection sensor **140** is positioned on the upper side in the gravitational direction with respect to the developer replenishment opening **43** (the developer replenishment shutter **44**) of the developer replenishment cartridge T (See FIG. **9**).

The detection sensor **140** is equipped with a light emitting portion **140***a* and a light receiving portion **140***b*. The detection sensor **140** is configured to detect any shielding object between the light emitting portion **140***a* and the light receiving portion **140***b* when the light receiving portion receives no detection light.

On the other hand, there is provided a moving member **141** which extends from the inner side to the outer side of the developer replenishment cartridge attachment portion **102**, passing through a connection hole **106***a* provided in the rear wall **106**. The moving member **141** is provided with a shielding portion **141***b* (detected portion) described below and a pressed portion **141***a*. The shielding portion **141***b* extends toward the detection sensor **140**, which is located above the connection hole **106***a*.

Further, the moving member **141** is supported by a moving member guide **106***b* provided on the rear wall **106** so as to be movable in a direction (indicated by the arrow U in the diagram) parallel to the attachment direction (indicated by the arrow R in the diagram) of the developer replenishment cartridge T. And, it is urged by a moving member spring **142** toward the upstream side in the developer replenishment cartridge T attachment direction (a direction opposite the direction of the arrow R in the diagram).

Next, the operation performed when attaching the developer replenishment cartridge T will be described with reference to FIGS. **9**A and **9**B. FIGS. **9**A and **9**B illustrate the operation of attaching the developer replenishment cartridge T. Of these diagrams, FIG. **9**A illustrates the state before the completion of the attachment of the developer replenishment cartridge T, and FIG. **9**B illustrates the state at the time of completion of the attachment of the developer replenishment cartridge T.

As illustrated in FIG. **9**A, before the completion of the attachment of the developer replenishment cartridge T, the shielding portion **141***b* (detected portion) of the moving member **141** is retreated from between the light emitting portion **140***a* and the light receiving portion **140***b* of the detection sensor **140**, and the detection sensor **140** does not detect the shielding portion. Accordingly, it detects that no developer replenishment cartridge has been attached yet.

On the other hand, as illustrated in FIG. **9**B, when the developer replenishment cartridge T is attached to the developer replenishment cartridge attachment portion **102**, a pressing portion **38** (See FIG. **9**A) of the developer replenishment cartridge T is pressed against the pressed portion **141***a* of the moving member **141**, and the moving member **141** moves to the downstream side in the attachment direction.

When the shielding portion **141***b* of the moving member **141** moves to a detection position (predetermined position) between the light emitting portion **140***a* and the light receiving portion **140***b* of the detection sensor **140**, the detection sensor **140** detects the shielding object. Through the detection of the shielding object by the detection sensor **140**, it is detected that the attachment of the developer replenishment cartridge T has been completed (i.e., the developer replenishment cartridge has been attached).

The system in which it is detected whether the developer replenishment cartridge T has been attached or not using the detection light, can involve the following problem.

Due to the airflow generated inside the developer replenishment cartridge attachment portion as a result of the attachment/detachment of the developer replenishment cartridge T, it can happen that the developer adhering to the surface of the developer replenishment cartridge, the walls forming the developer replenishment cartridge attachment portion, the upper surface of the process cartridge P, etc., may be scattered.

In particular, when the attachment/detachment of the developer replenishment cartridge T and of the process cartridge P is frequently repeated, or abnormality occurs such as the opening and closing of their shutters being impossible at the time of attachment/detachment, a large amount of developer may adhere to the surfaces of the developer replenishment shutter **44** and of the developer reception shutter **26**.

When, in this state, the developer replenishment cartridge T is attached, the developer adhering to the surface of the shutter will be scattered in the developer replenishment cartridge attachment direction.

When the scattered developer adheres to the light emitting portion **140***a* and the light receiving portion **140***b* of the detection sensor **140**, a reduction in a light emission amount and a light reception amount occurs, which may cause the detection sensor **140** to erroneously detect the shielding object.

In the present exemplary embodiment, the shielding portion **141***b* moves to the detection position above the pressed portion **141***a*, and it detected whether or not the developer replenishment cartridge T has been attached through detection light passing that position. Due to this configuration, as compared with the case where the shielding object is detected at the same height as the pressed portion **141***b*, the amount of scattered developer to reach the detection position is reduced, so that it is possible to suppress erroneous detection of the cartridge attachment state.

Further, in the configuration according to the present exemplary embodiment, the detection sensor **140** is provided on the downstream side of the developer replenishment cartridge attachment portion **102** in the developer replenishment cartridge T attachment direction (on the downstream side of the rear wall **106** in the developer replenishment cartridge T attachment direction). Further, the pressing portion **38** is partitioned from the pressed portion **141***a* and the shielding portion **141***b* by the rear wall **106**.

Due to the above construction, it is possible to suppress movement of the scattered developer to the downstream side of the rear wall **106** in the replenishment cartridge T attachment direction, so that it is possible to reduce the adhesion of

developer to the surface of the detection sensor **140**. Thus, it is possible to suppress a reduction in light emission amount and in light reception amount due to adhesion of developer to the light receiving portion **140***b*, and to prevent the detection sensor **140** from erroneously detecting the shielding object. Therefore, it is possible to more reliably detect the attachment condition of the developer replenishment cartridge T.

Next, a second exemplary embodiment of the present invention will be described. In the present exemplary embodiment, the basic configuration of the development device, of the process cartridge, of the developer replenishment cartridge, and of the image forming apparatus is the same as that of the first exemplary embodiment. Accordingly, the components having functions and configurations the same as or equivalent to those of the first exemplary embodiment are indicated by the same reference numerals, and a detailed description thereof will not be given.

In the following, the configuration for detecting the attachment of the developer replenishment cartridge according to the present exemplary embodiment will be described in detail.

First, an attachment portion for the developer replenishment cartridge T**2** with respect to the apparatus main body **100** will be described with reference to FIGS. **10**, **11**, and **12**.

FIG. **10** is an overall view of the developer replenishment cartridge T**2** according to the present exemplary embodiment.

FIG. **11** is a front view of the process cartridge attachment portion **101** and the developer replenishment cartridge attachment portion **102** of the apparatus main body **100**.

FIG. **12** is a detailed view of the developer replenishment cartridge attachment portion **102** in the apparatus main body **100** rear side according to the present exemplary embodiment.

As illustrated in FIG. **10**, on the upper portion of the developer replenishment cartridge T**2**, there is provided a pressing portion **48** for operating a moving member **241**.

As illustrated in FIG. **11**, on the front side of the developer replenishment cartridge attachment portion **102**, there is provided an upstream groove **105** corresponding to the pressing portion **48** at the time of attachment of the developer replenishment cartridge T**2**.

When attaching the developer replenishment cartridge T**2** to the developer replenishment cartridge attachment portion **102**, the pressing portion **48** passes in the upstream groove **105**. The pressing portion **48** can also be used as a member for identifying each developer replenishment cartridge **12** (T**2**Y, T**2**M, T**2**C, and T**2**K). In a state in which the developer replenishment cartridge T**2** is attached to the image forming apparatus main body, an upper wall **104** is provided above the replenishment cartridge.

As illustrated in FIG. **12**, a detection sensor **240** according to the present exemplary embodiment is provided further above the upper wall **104** (the second partition member). Further, there is provided a moving member **241** extending from the inner side toward the outer side of the developer replenishment cartridge attachment portion **102** through a connection hole **104***a* provided in the upper wall **104**.

Like the moving member **141** according to the first exemplary embodiment, the moving member **241** is equipped with a shielding portion **241***b* and a pressed portion **241***a*. The pressed portion **241***a* and the pressing portion **48** are partitioned from the shielding portion **241***b* by the upper wall **104**.

Further, the moving member **241** is supported by a moving member guide **104***b* provided on the upper wall **104** so as to be movable in a direction (indicated by the arrow U in the diagram) parallel to the developer replenishment cartridge T**2** attachment direction (indicated by the arrow R in the diagram). And, the moving member **241** is urged by a moving member spring **242** toward the upstream side in the developer replenishment cartridge T**2** attachment direction (in the direction opposite to the direction indicated by the arrow R in the diagram).

Next, the operation performed when attaching the developer replenishment cartridge T**2** will be described with reference to FIGS. **13**A and **13**B.

FIGS. **13**A and **13**B are diagrams illustrating the operation of attaching the developer replenishment cartridge T**2**. Of these diagrams, FIG. **13**A illustrates the state before the completion of the attachment of the developer replenishment cartridge T**2**, and FIG. **13**B illustrates the state at the time of completion of the developer replenishment cartridge T**2**.

As illustrated in FIG. **13**A, before the completion of the attachment of the developer replenishment cartridge T**2**, the shielding portion **241***b* of the moving member **241** is retreated from between the light emitting portion **240***a* and the light receiving portion **240***b* of the detection sensor **240**, which detects no shielding object.

On the other hand, as illustrated in FIG. **13**B, when attaching the developer replenishment cartridge T**2** to the developer replenishment cartridge attachment portion **102**, the pressing portion **48** of the developer replenishment cartridge T**2** is pressed against the pressed portion **241***a* of the moving member **241**, and the moving member **241** moves to the downstream side in the attachment direction. Then, the shielding portion **241***b* of the moving member **241** enters the space between the light emitting portion **240***a* and the light receiving portion **240***b* of the detection sensor **240**, and the detection sensor **240** detects the shielding object.

The determination by the detection sensor **240** as to whether or not the attachment of the developer replenishment cartridge T**2** has been completed is similar to that in the first exemplary embodiment, so that a description thereof will be omitted.

In addition to the effects of the first exemplary embodiment, the present exemplary embodiment provides the following effects.

In the present exemplary embodiment, the detection sensor **240** is provided above the upper wall **104**. As a result, it is possible to arrange the detection sensor **240** away from the developer replenishment opening **43**. Further, the developer replenishment cartridge T**2** and the upper wall **104** intercept the scattered developer, whereby it is possible to further reduce the amount of developer adhering to the surface of the detection sensor **240**.

Thus, it is possible to suppress a reduction in light emission amount and light reception amount due to adhesion of developer to the light emitting portion **240***a* and the light receiving portion **240***b*, and to prevent erroneous detection of the shielding object by the detection sensor **240**. As a result, it is possible to detect still more reliably the completion of the attachment of the developer replenishment cartridge T**2**.

While in the first and second exemplary embodiments the developer replenishment cartridge has the pressing portion **48**, it is also possible for the process cartridge P to have the pressing portion, detecting whether or not the process cartridge P has been attached by using a moving member **241** and a detection sensor **240** similar to those of the first and second exemplary embodiments. In this way, it is possible to suppress erroneous detection of whether the process cartridge P has been attached or not.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be

accorded the broadest interpretation so as to encompass all modifications, equivalent structures, and functions.

This application claims priority from Japanese Patent Application No. 2011-215335 filed Sep. 29, 2011, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. An image forming apparatus comprising:

a development unit configured to develop an electrostatic image formed on an electrophotographic photosensitive member;

a cartridge, which is detachable from an image forming apparatus main body, configured to replenish the development unit with developer;

a moving member equipped with a pressed portion and a detected portion, in which the detected portion is configured to move to a predetermined position by the pressed portion being pressed by the cartridge when the cartridge is attached to the image forming apparatus main body;

a detection device configured to detect whether the cartridge is attached by detection light passing the predetermined position, and

a partition member configured to partition the cartridge and the detected portion,

wherein the moving member is provided so as to extend through a hole provided in the partition member.

2. The image forming apparatus according to claim **1**, wherein the partition member is provided above the cartridge in a state in which the cartridge is attached to the image forming apparatus main body.

3. The image forming apparatus according to claim **1**, wherein the partition member is provided on the downstream side of the cartridge in the cartridge attachment direction in a state in which the cartridge is attached to the image forming apparatus main body.

4. The image forming apparatus according to claim **1**, wherein the detected portion is located above a replenishment opening provided in the cartridge in order to replenish the development unit with developer.

5. The image forming apparatus according to claim **1**, wherein the shutter is positioned on a lower side in a gravitational direction with respect to the detected portion.

6. The image forming apparatus according to claim **1** further comprising a partition member configured to partition the pressed portion and the detected portion.

7. The image forming apparatus according to claim **1**, wherein the cartridge has a shutter and the shutter is positioned on a lower side with respect to the detected portion.

8. A cartridge for replenishing a development unit that develops an electrostatic image formed on an electrophotographic photosensitive member with developer and detachable from an image forming apparatus main body,

wherein the image forming apparatus main body includes:

a moving member equipped with a pressed portion and a detected portion, in which the detected portion is configured to move to a predetermined position by the pressed portion being pressed by the cartridge when the cartridge is attached to the image forming apparatus main body; and

a detection device configured to detect whether the cartridge is attached by detection light passing the predetermined position,

wherein the cartridge includes a pressing portion configured to move the detected portion to the predetermined position above the pressed portion by pressing of the pressed portion when the cartridge is attached to the image forming apparatus main body,

wherein the moving member is provided so as to extend through a hole provided in a partition member.

9. The cartridge according to claim **8**, wherein the pressing portion is partitioned from the detected portion by a partition member provided in the image forming apparatus main body in a state in which the cartridge is attached to the image forming apparatus main body.

10. The cartridge according to claim **8**, wherein the pressing portion is partitioned from the detected portion by a partition member provided above the cartridge in a state in which the cartridge is attached to the image forming apparatus main body.

11. The cartridge according to claim **8**, wherein the pressing portion is partitioned from the detected portion by a partition member provided on the downstream side of the cartridge in a cartridge attachment direction in a state in which the cartridge is attached to the image forming apparatus main body.

12. The cartridge according to claim **8**, wherein the shutter is positioned on a lower side in a gravitational direction with respect to the detected portion.

13. The cartridge according to claim **8**, wherein the cartridge has a shutter and the shutter is positioned on a lower side with respect to the detected portion.

14. An image forming apparatus comprising:

a cartridge, which is detachable from an image forming apparatus main body, configured to store developer used for image formation;

a moving member equipped with a pressed portion and a detected portion, in which the detected portion is configured to move to a predetermined position by the pressed portion being pressed by the cartridge when the cartridge is attached to the image forming apparatus main body;

a detection device configured to detect whether the cartridge is attached by detection light passing the predetermined position; and

a partition member configured to partition the cartridge and the detected portion,

wherein the moving member is provided so as to extend through a hole provided in the partition member.

15. The image forming apparatus according to claim **14**, wherein the partition member is provided above the cartridge in a state in which the cartridge is attached to the image forming apparatus main body.

16. The image forming apparatus according to claim **14**, wherein the partition member is provided on the downstream side of the cartridge in the cartridge attachment direction in a state in which the cartridge is attached to the image forming apparatus main body.

17. The image forming apparatus according to claim **14**, wherein the cartridge further comprises

an electrophotographic photosensitive member; and

a developer carrying member configured to carry developer and to develop an electrostatic image formed on the electrophotographic photosensitive member.

18. The image forming apparatus according to claim **14**, wherein the cartridge is a developer replenishment cartridge.

19. The image forming apparatus according to claim **14** further comprising a partition member configured to partition the pressed portion and the detected portion.

20. A cartridge, which is detachable from an image forming apparatus main body, configured to store developer,

wherein the image forming apparatus main body includes:

a moving member equipped with a pressed portion and a detected portion, in which the detected portion is configured to move to a predetermined position by the

pressed portion being pressed by the cartridge when the cartridge is attached to the image forming apparatus main body; and

a detection device configured to detect whether the cartridge is attached by detection light passing the predetermined position and

a partition member configured to partition the pressed portion and the detected portion,

wherein the moving member is provided so as to extend through a hole provided in the partition member, and

wherein the cartridge has a pressing portion configured to move the detected portion to the predetermined position above the pressed portion by pressing the pressed portion when the cartridge is attached to the image forming apparatus main body.

21. The cartridge according to claim **20**, wherein the pressing portion is partitioned from the detected portion by a partition member provided above the cartridge in the state in which the cartridge is attached to the image forming apparatus main body.

22. The cartridge according to claim **20**, wherein the pressing portion is partitioned from the detected portion by a partition member provided on the downstream side of the cartridge in a cartridge attachment direction in the state in which the cartridge is attached to the image forming apparatus main body.

23. The cartridge according to claim **20**, further comprising:

an electrophotographic photosensitive member; and

a developer carrying member configured to carry developer and to develop an electrostatic image formed on the electrophotographic photosensitive member.

24. The image forming apparatus according to claim **20**, wherein the cartridge further comprises

an electrophotographic photosensitive member; and

a developer carrying member configured to carry developer and to develop an electrostatic image formed on the electrophotographic photosensitive member.

25. The image forming apparatus according to claim **20**, wherein the cartridge is a developer replenishment cartridge.

26. The cartridge according to claim **20**, wherein the cartridge has a shutter and the shutter is positioned on a lower side with respect to the detected portion.

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